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Eclipses during the 2010 eruption of the recurrent nova U Scorpii

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Abstract

The eruption of the recurrent nova U Scorpii on 2010 January 28 is now the all-time best observed nova event. We report 36,776 magnitudes throughout its 67 day eruption, for an average of one measure every 2.6 minutes. This unique and unprecedented coverage is the first time that a nova has had any substantial amount of fast photometry. With this, two new phenomena have been discovered: the fast flares in the early light curve seen from days 9-15 (which have no proposed explanation) and the optical dips seen out of eclipse from days 41-61 (likely caused by raised rims of the accretion disk occulting the bright inner regions of the disk as seen over specific orbital phases). The expanding shell and wind cleared enough from days 12-15 so that the inner binary system became visible, resulting in the sudden onset of eclipses and the turn-on of the supersoft X-ray source. On day15, a strong asymmetry in the out-o--eclipse light points to the existence of the accretion stream. The normal optical flickering restarts on day 24.5. For days 15-26, eclipse mapping shows that the optical source is spherically symmetric with a radius of 4.1 R⊙. For days 26-41, the optical light is coming from a rim-bright disk of radius 3.4 R ⊙. For days 41-67, the optical source is a center-bright disk of radius 2.2 R⊙. Throughout the eruption, the colors remain essentially constant. We present 12 eclipse times during eruption plus five just after the eruption.

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Keywords

novae, cataclysmic variables, stars: individual (U Sco)